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OF OUTER SPACE

Centres for Space Science and Technology Education

Capability development in and data management for environmental assessment and natural resources management

Updated project document

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EXECUTIVE SUMMARY

The recent United Nations Conference on Environment and Development brought to centre stage the global need for a greater concern for the environment and for a better understanding of the needs of developing nations. Long before the many heads of State gathered at Rio de Janeiro, the United Nations initiated steps to establish, through its Space Applications Programme (Office for Outer Space Affairs), regional Centres for Space Science and Technology Education in existing educational/research institutions in the developing countries. Those steps are getting closer to bearing fruit. These Centres have the potential to contribute significantly to the implementation of the recommendations of the Rio Conference, otherwise known as Agenda 21, and to the successful execution of the programme of activities of the user communities in the developing countries. At present, there are no prior or ongoing programmes which provide such in-depth educational opportunities as are contained in the present project document.

This project will develop, through in-depth education, indigenous capabilities for research and applications in remote-sensing technology, satellite meteorology, Geographic Information Systems (GIS) and data management as part of the essential tools for environmental assessment and natural resources management - essential steps for ensuring sustainable development.

The project will have a multiplying effect, fuelled by national motivation and commitment as well as international cooperation, and will result in the capacities:

(i) To enable each country to enhance its knowledge and experience, particularly in those application areas (air/land/water) that have the potential for a greater impact on each country's economic and social development, including preservation of its environment;

(ii) To utilize data from Earth Observing Systems, for weather prediction and monitoring of hurricanes and other natural phenomena so that they may undertake appropriate disaster management and mitigation programmes;

(iii) To enable each country to support research-and-development efforts in its national institutions, especially those dealing with the understanding and application of environmental information systems;

(iv) To develop environmental and atmospheric sciences curricula that can be easily taught and demonstrated at the high school and university levels in each country and to effectively prepare the educators to teach classes in these disciplines on their return to their institutions;

(v) To participate in regional and international environmental programmes such as the International Geosphere-Biosphere Programme and Mission to Planet Earth and to contribute effectively to the understanding and support of international actions on such issues as global warming and climate change, ozone layer depletion, global deforestation, land degradation and management of the coastal marine environment.

Each of these regional Centres will be established at a major national science-and-technology-oriented university or research institution. Such an arrangement will enable the Centre to optimally utilize the existing professional staff and physical infrastructure at the host institution. The participants in the programmes of the Centres should be able to collaborate with the graduates of existing training and user assistance centres on major research-and-application projects for the benefit of their countries.

In order to ensure the viability of these Centres on a long-term basis, countries offering to host the Centres have been requested by the United Nations to demonstrate their commitment to the financial survival of the Centre they plan to host. These arrangements should ensure that host countries demonstrate a greater degree of commitment to the Centre than has hitherto been the case on previous regional projects. The host institutions identified by these potential host countries are contained in annex VIII to the present project document. Other arrangements for funding and technical and material support, including those requested of the United Nations Development Programme (UNDP), are detailed in this project document.

The United Nations has begun to organize evaluation missions, on a regional basis, to each of the potential host countries and their institutions. Each of these missions should provide an accurate and informative report that could assist in the selection of the host country/institution(s) for each regional Centre.

The present project document also addresses (sect. XII) the requirements (e.g., qualifications and screening of candidates at the national level) for participation in the programmes of the Centres; it also focuses on the obligations of each participant and his/her country and the responsibilities of Member States to the Centres.

I. BACKGROUND

1. The ever changing state of planet Earth, brought about in part by human interventions, is giving rise to global concern. Today, the areas of concern centre on such phenomena as global desertification, deforestation, soil erosion, acid rain and air and water pollution, among others; these are individually and collectively creating a global change whose magnitude and direction are largely unknown.

2. Countermeasures aimed at correcting these environmental problems have been proposed and in some cases agreed to at intergovernmental levels. For example, the General Assembly in its resolution 1721 C (XVI) of 20 December 1961 called for studies on measures to advance the state of atmospheric science and technology in order to improve weather forecasting capabilities and to further the study of the basic physical processes that affect climate. Today, a number of countries and intergovernmental and non-governmental organizations are studying these problems in order to formulate appropriate policies. For example, the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU) responded to the aforementioned resolution of the General Assembly and mounted the Global Atmospheric Research Programme (GARP) to observe the global atmosphere on an intensive scale and to have an unprecedented description of it through one annual cycle. The achievements of GARP are well known, including: (a) the development of new and advanced methods of data acquisition and analysis, (b) marked improvements in weather forecasting, and (c) accelerated progress in climate research by stimulating the development of global models.

3. The Brundtland report of 1987 1/ detailed the concept of "sustainable development" and identified the latter as the best strategy to meet development demands while simultaneously preserving and improving the environment. In June 1992, Brazil hosted the United Nations Conference on Environment and Development (UNCED), 2/ with a view to forging the emergence of cooperative, collective and global environmental conservation and management strategies. This has resulted in, among other things, the elements embodied in Agenda 21. The latter constitutes a high-level political agreement by the 178 Governments present at the Conference on the need to strengthen and support local capabilities for shaping national development strategies.

4. The role of Earth Observing Systems in the programmes of Agenda 21 were very specific. Agenda 21, for example, calls on all countries to undertake:

> "... a comprehensive national inventory of their land resources in order to establish a land information system in which land resources will be classified according to their most appropriate uses and environmentally fragile or disaster-prone areas will be identified for special protection measures". 3/

For this and other purposes,

> "All countries, particularly developing countries, alone or in regional or subregional groupings, should be given access to modern techniques of land-resource management, such as geographical information systems, satellite photography/imagery and other remote-sensing technologies." 4/

5. In the area of agriculture, Agenda 21 stressed that Government at the appropriate level, with the support of the relevant international and regional organizations, should:

> "Develop databases and geographical information systems to store and display physical, social and economic information pertaining to agriculture, and the definition of ecological zones and development areas". 5/

6. The issues of coastal and marine areas including exclusive economic zones, and the development of human resources capacities and scientific and technological means to address these issues, were the core of chapter 17 of Agenda 21.

7. On the subject of the "Protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water resources", chapter 18 of Agenda 21 observed that

> "The development of interactive databases, forecasting methods and economic planning models appropriate to the task of managing water resources in an efficient and sustainable manner will require the application of new techniques such as geographical information systems and expert systems to gather, assimilate, analyse and display multisectoral information and to optimize decision-making." 6/

Environmental information: exploring the Earth from space

8. In the last two decades, the world has witnessed the evolution of Earth observation from space, a process that has introduced new dimensions into the collection of Earth resources and environmental data. Of equal importance is the rapid analysis and effective utilization of these data in a coherent manner in order to establish the trend of ongoing local, regional and global changes, and to formulate appropriate policies that could address them.

9. Experiences gained from regional and global research efforts are now being transferred to a number of major global environmental and resource development programmes; Earth observation satellites will serve as essential tools in these endeavours.

10. Specifically, the international community is now embarking on a number of long-term programmes such as the International Geosphere-Biosphere Programme

(IGBP) and Mission to Planet Earth (MPE). The objective of IGBP is to describe and understand the interactive physical, chemical and biological processes that regulate the total Earth system, including the changes that are occurring in this system, and the manner in which they are influenced by human activities. In order to facilitate regional collaboration and research efforts on these global change issues, ICSU, the sponsor of IGBP, plans to establish a network of regional research centres around the world.

11. Through MPE, a programme initiated by most of the space-faring nations, internationally coordinated space-based platforms will chart pollution, deforestation, the greenhouse effect, depletion of the ozone layer and other threats to the Earth's environment. In July 1989, the participants in the Economic Summit held in Paris added their voices to the global concern on the interrelationship between the state of the Earth's atmosphere and the well-being of mankind on Earth by concluding that "decisive action is urgently needed to understand and protect the Earth's ecological balance ... We urge all countries to give further impetus to scientific research on environmental issues, to develop necessary technologies and to make clear evaluations of the economic costs and benefits of environmental policies". 7/

12. Because of the ever-expanding frontier of knowledge in science and technology, including Earth observation from space, the acquisition, transmission, processing, analysis and utilization of environmental information in social and economic development programmes will be intensified with the passage of time. The latest effort in this regard is microwave remote sensing which, because of its all-weather capability, can penetrate rain and clouds, thus enhancing the possibilities of obtaining needed information from cloud-covered uncharted areas, particularly the tropics.

13. Today, many countries, particularly the industrialized countries, are applying high-resolution satellite data to upgrade their Earth resources and different aspects of their environmental information systems. Such information is finding wide applications, particularly in water resources, forest and crop inventories, geological and mineral exploration, environmental management, including weather forecasting, and agrometeorology, cartography and mapping and their subsequent use in the development of roads, pipelines, power lines and related engineering applications, land use and urban development, oil pollution survey and monitoring, assessment and management of coastal/marine environment and ocean resources, disaster assessment and the monitoring of the environmental impact of human activities.

14. For a long time to come, space-borne sensors will be the only reliable sources of data, in some cases obtained for the first time, on the environment and natural resources in most developing countries. The availability of such data can assist these countries to gain a better understanding of how to safeguard their environment as well as ensure a more efficient management and sustainable development of their natural resources. Such information can serve as a basis for decision-making as well as for assessing the outcome of past decisions.

15. Prior to the 1992 UNCED Conference, major international funding agencies and institutions responsible for bilateral aid had requested the use of such environmental information in the execution of projects they funded. During the past few years, United Nations offices and specialized agencies (such as the United Nations Environment Programme (UNEP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Food and Agriculture Organization of the United Nations (FAO), UNDP and the World Bank) and the Commission of the European Communities (CEC) have employed remote-sensing data, especially the data acquired by the Landsat Thematic Mapper (TM), SPOT and Marine Observation Satellites (MOS) for use in programmes and projects in developing countries. Through a number of executing agencies, UNDP is carrying out many projects in which remote-sensing data have been an input. Projects to be executed within the Global Environment Facility, a joint programme of the World Bank, UNEP and UNDP, will also make use of remote-sensing data.

II. JUSTIFICATION

A. Existing level of knowledge, access to data and use of information

16. Although all countries are contributing to global environmental problems, not all countries have the requisite capability needed for the solution of these problems. Without such a capacity at the local level, the contributions of the developing countries to the programmes of Agenda 21, and to such other programmes as Mission to Planet Earth and the International Geophysical Biosphere Programme will be very limited.

17. Among the many factors that create bottlenecks in project implementation in the developing countries are: (a) the shortage of qualified human resources at the local level; (b) the resulting dependence of most projects on foreign expertise; and (c) lack of adequate information for policy formulation and efficient project implementation.

B. Dependence on foreign talent

18. The majority of environmental information systems and other technology related projects in developing countries depend upon foreign experts for their implementation. However, once the foreign experts are withdrawn, such projects often falter. One of the major reasons for such failures is that the country counterparts are generally not versed in the fundamentals of the principles/concepts being applied. Country counterparts often acquire their knowledge through short-term training courses, which are applications-oriented and are usually conducted abroad, or through on-the-job training at home. Such individuals are taught skills that are tailor-made for specific tasks. In most instances, it is impossible to adapt such skills to other tasks without a fundamental knowledge and an understanding of the principles and methodology involved.

19. Only an in-depth education programme can provide such knowledge and skills. The existence of such a local capability is essential to ensure that the resources that will be invested by the international and national communities are efficiently utilized.

C. Needed: in-depth long-term education

20. Most of the activities being executed in the developing countries either through bilateral aid or by international funding agencies are also carried out as part of a "technology transfer" process. In addition, technology transfer can lead to knowledge development if it also provides an environment through which local scientists and technologists can gain a good understanding and knowledge of how and why the technology that is being applied works the way it does.

21. There is an emerging consensus within the international community that if technology transfer is to succeed, efforts must be devoted to knowledge development at the local level. Such an approach should provide the participating individuals with the necessary educational opportunities, taking into full consideration the local economic, cultural and infrastructural conditions.

22. The availability of data alone does not ensure that a programme will succeed. Analytical capability is a prerequisite to a successful data analysis and technology transfer effort. However, many institutions in the developing countries lack rigorous technical capability and are thus constrained in their ability to impart technically based knowledge. It is imperative that those in the forefront of data management operations be exposed to analysis and applications of environmental and natural resources data through an intensive educational process. Such an approach should provide an appropriate environment for the assimilation of the fundamental principles involved, which is critical to the successful development of knowledge in the discipline.

23. The World Bank has also examined the development of indigenous capability through education and training, particularly in Africa. In its 1989 report entitled Sub-Saharan Africa: From Crisis to Sustainable Growth, the Bank observed that if Africa is to benefit from advances in environmental information systems and related sciences and technologies, it must improve its science and technology education and training and aim at the highest standards for at least a minimum core of specialists. Foreign aid should "be devoted to building excellence and relevance in African science and technology and helping to link institutions to others outside Africa". 8/

24. At its Third Meeting, held at Heidelberg, Germany, from 10 to 12 April 1991, the Advisory Committee of the World Bank's Programmme on Environment Information Systems in Sub-Saharan Africa noted that "most cooperation programmes are geared to short training sessions to fill short term objectives. 9/ On education and training, the Committee also noted that:

(i) "If a country is to have an effective environment information system, it must have policy-makers and administrators capable of appreciating the applications and implications of the information, and scientists, engineers, technicians and teachers capable of developing, adapting, applying and teaching the technology. Both education and training are required to build up these skills"; and that

(ii) "Education provides the individual with an understanding of the subject, and training teaches him to carry out specific tasks, when knowledge of the subject as a whole may not be essential. To create the awareness, flexibility and motivation necessary to adjust to rapidly changing conditions, education is likely to be more effective than training for tasks which, because of the nature of new technologies, alter very quickly." 9/

25. The Committee concluded its meeting with the following recommendations:

(i) "A professional approach to environment information as the basis for the viable sustainability of environment information systems 'should be encouraged.' Staff capacity must be developed in the short, medium and long term. In the short term, needs can be met by training courses and self-training. In the longer term, basic education and university courses must cover environmental concerns and related subjects, including the information aspects, more thoroughly;"

(ii) "African university courses relating to environment information [should] be developed, and ... they should be tied in with national environment information programmes. Students should have the opportunity to get practical experience in operational systems. [The Committee] endorses the strengthening of all viable university resources, and university networking is commended;"

(iii) "Cooperation based on long-term partnerships [should] be established between more developed institutions and African ones (both public and private institutions), to ensure the continuity of technology transfer. Such cooperation programmes should include long-term educational and staff-training schemes." 10/

26. In a recently released report of Directorate General VIII of the Commission of the European Communities, the latter noted that "Conventional approaches to technology transfer, such as training courses and short-term, in-country demonstration projects are useful educational tools, but on their own, they will not result in effective and permanent integration of remotely sensed techniques into operational programmes". 11/

27. In identifying the several steps needed to arrive at practical applications of remote sensing for environmental monitoring and natural resources management, the CEC report observed that (a) "research and

development are needed to integrate remote-sensing techniques into resource management systems"; and (b) "research and development of remote-sensing data processing, analysis and interpretation provide the scientific basis for application of the techniques". 12/

28. The 1987 Brundtland report recommended that "environmental education should be included in and should run throughout the other disciplines of the formal education curriculum at all levels - to foster a sense of responsibility for the state of the environment and to teach students how to monitor, protect and improve it ... Global awareness could be fostered by encouraging contacts among teachers from different countries, for instance, in specialized centres set up for this purpose". 13/

D. Data availability, management and utilization

29. Data are needed for overall national and district-level planning, for project implementation, for harnessing of a given resource and for the monitoring and assessment of the environmental impact of a given development programme.

30. However, gaining access to biophysical data, particularly space-acquired data of the Earth and its environment, has been difficult for a number of countries. For these and many other countries, their baseline data are either incomplete or non-existent.

31. In cases where data are available, there is often a lack of awareness of what is available, its value and usefulness. There is also very little communication between those who have the data and those who need it for decision-making.

32. There is a need to establish a data management programme that will enhance the skills of the user community in the developing countries so that they may have the capabilities:

(i) To develop guidelines for data collection;

(ii) To standardize physical and social economic data collection processes;

(iii) To develop guidelines for data geo-referencing;

(iv) To undertake the integration of socio-economic and biophysical data;

(v) To establish valid and complete national baseline information.

III. EVOLUTION OF THE PROJECT

33. In order to build the needed capacities in the developing countries, the latter would need a highly educated core of: (a) specialists who could provide appropriate education in the main areas proposed in the above-mentioned World Bank, Brundtland and UNCED (Agenda 21) reports; (b) research-and-application scientists who could initiate and carry out research-and-application programmes that could address the various aspects of Agenda 21; (c) environmental information for the execution of these activities; and (d) tools such as Geographic Information Systems (GIS) that could facilitate the analysis of large volumes of diverse information for both policy formulation and applications.

A. United Nations Programme on Space Applications

34. In 1971, the General Assembly, by its resolution 2776 (XXVI) of 29 November 1971, established the United Nations Programme on Space Applications and mandated the Programme to provide awareness in this technology to Member States, particularly the developing countries, and to assist them to develop essential capabilities (human resources and infrastructure development) so that they could employ the technology in their social and economic development plans.

35. Following the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82) held in 1982 at Vienna, 14/ the General Assembly, in its resolution 37/90 of 10 December 1982, mandated the Programme to focus its attention on the following:

(1) Development of indigenous capability at the local level;

(2) Provision of technical advisory services;

(3) Provision of information in space science and technology;

(4) Development of long-term fellowship programmes;

(5) Organization of training courses, workshops and seminars in space science and technology;

(6) Promotion of greater cooperation in space science and technology between developed and developing countries and among developing countries.

36. Annex I to the present document contains a list of the activities that have been carried out under the auspices of the Programme from the conclusion of UNISPACE 82 through 1991. At the present moment, the central core of the activities of the Programme is the development of indigenous capability at the local level. Details of this effort are described below.

37. Between 1983 and 1986, the United Nations Programme on Space Applications undertook an evaluation of Member States' needs and requests in different aspects of space science and technology, including aspects of environmental information systems. The results of this evaluation reveal that there is a major need in the developing countries for intensive indigenous capability development, which can only be attained through long-term educational programmes. Also high on the list of priorities were the need for: (a) in-depth education in the fundamentals of the various fields of space science and technology as these relate to sustainable development of natural resources; (b) opportunities to gain experience in a research environment; and (c) access to data and adequate facilities that could be used for their processing and analysis.

38. Beginning in 1985, the United Nations, through its Space Applications Programme, embarked on a path towards the development of indigenous capability in space science and technology at the local level through one international and three regional meetings organized on the subject. The participants at these meetings concluded that in order for the developing countries to contribute effectively to the solution of global, regional and national environmental and resource management problems, there was an urgent need for a higher level of knowledge and expertise in the relevant disciplines by educators as well as by research-and-application scientists in those countries. That capability, they further noted, could only be acquired through long-term intensive education.

B. Centres for Space Science and Technology Education

39. On the basis of the above recommendations, the United Nations Programme on Space Applications (Office for Outer Space Affairs) prepared a proposal (SAP/90/001-004) for the establishment of regional Centres for Space Science and Technology Education at existing institutions (research or higher education) in the developing countries.

40. In support of the above initiative of the Programme, the General Assembly, at its forty-fifth session, in its resolution 45/72 of 11 December 1990, endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that:

> "the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries". 15/

IV. IMMEDIATE OBJECTIVES

41. These Centres shall be teaching and research institutions that are capable of high attainments in the development and transmission of knowledge in the developing countries. Given the global realities and concerns of our time, the initial emphasis of the Centres shall concentrate on in-depth education, research-and-applications programmes in remote-sensing technology, satellite meteorology and Geographic Information Systems (GIS) as part of the essential tools for environmental monitoring and natural resources management which are indispensable elements of sustainable development.

42. Specifically, the Centres for Space Science and Technology Education will be established at an existing and viable institution of higher learning or a research centre in each region (Economic Commission for Africa (ECA), Economic Commission for Europe (ECE), Economic Commission for Latin America and the Caribbean (ECLAC), Economic and Social Commission for Asia and the Pacific (ESCAP) and Economic and Social Commission for Western Asia (ESCWA). The programme of each Centre will:

(a) Develop the skills and knowledge of university educators, environmental research scientists and project personnel, initially in remote sensing and related technologies for subsequent application in national development and environmental management programmes;

(b) Assist educators to develop environmental and atmospheric sciences curricula that they can use to advance the knowledge of their students in their respective institutions/countries;

(c) Develop the skills of the environmental research scientists and project personnel in the design, development and application of remote-sensing techniques in natural resources management and biodiversity protection;

(d) Assist research scientists and project personnel in preparing the space-derived information for presentation to the policy and decision makers in charge of national and regional development programmes;

(e) Enhance regional and international cooperation in space science and technology programmes, particularly those that are related to environmental monitoring and natural resources management, and support and contribute to the work of institutions of higher learning in each region and the activities of national/regional remote-sensing user assistance and training centres;

(f) Assist in disseminating to the general public the value of space science and technology in improving their everyday quality of life.

V. LONG-TERM OBJECTIVES

43. Each of the regional Centres for Space Science and Technology Education will (a) contribute to sustainable development of natural resources (air/water/land) and (b) provide an input for biodiversity conservation and other related environmental programmes through the development of in-depth knowledge and skills of educators and research and application scientists in environmental information systems with emphasis on remote sensing, satellite meteorology and relevant technologies at the local level.

44. The project will result in the development of indigenous capability in developing countries so that the latter may design and implement education research-and-applications programmes, initially in environmental and natural information systems. This process should equip these countries to provide the skills and knowledge needed, especially in space-based Earth Observing Systems (including remote sensing and satellite meteorology) and in the use of Geographical Information Systems (GIS) to implement national developmental programmes, particularly those embodied in Agenda 21.

45. The successful establishment of programmes in education, research and applications, with emphasis on Earth Observing Systems for sustainable development, will have a multiplying effect, fueled by national motivation and commitment as well as international cooperation, and will result in the capacities:

(i) To enable each country to enhance its knowledge and experience particularly in those application areas (air/land/water) that have the potential for a greater impact on each country's economic and social development, including preservation of its environment;

(ii) To utilize data from Earth Observing Systems for weather prediction and monitoring of hurricanes and other natural phenomena so that they may undertake appropriate disaster management and mitigation programmes;

(iii) To enable each country to support research-and-development efforts in its national institutions, especially those dealing with the understanding and application of environmental information systems;

(iv) To develop an environmental and atmospheric sciences curricula that can be easily taught and demonstrated at the high school and university levels in each country and to effectively prepare the educators to teach classes in these disciplines on their return to their institutions;

(v) To participate in regional and international environmental programmes such as IGBP and MPE and to contribute to the understanding and support of international actions on such issues as global warming and climate change, ozone layer depletion, global deforestation, land degradation and management of the coastal marine environment.

VI. THE USER COMMUNITY

46. The potential user community (i.e., the beneficiaries) of the capabilities to be provided by these Centres includes:

(i) National resource and environmental agencies (ministries of agriculture, water resources, planning, works, geological surveys);

(ii) National and regional research institutions such as the proposed Regional Institutes for Global Change Research (e.g., the Inter-American Institute for Global Change Research), International Institute for Tropical Agriculture (Nigeria), International Centre for Agricultural Research in Dry Areas (Syrian Arab Republic), International Commission for the Scientific Exploration of the Mediterranean Sea (Monaco), International Centre for Tropical Agriculture (Colombia), International Crops Research Institute for the Semi-Arid Tropics (India), International Council for Research in Agroforestry (Kenya), International Irrigation Management Institute (Sri Lanka), International Rice Research Institute (Philippines) and International Red Locust Control Organization for Central and Southern Africa (Zambia);

(iii) Universities and technical colleges at the national level.

VII. THE PROGRAMME OF EACH CENTRE

47. The principal functions of each Centre will focus on: (a) education, research and application programmes; (b) data management; (c) pilot projects; (d) continuing education programmes through workshops and seminars; and (e) awareness programmes for policy/decision makers and the general public.

A. Education, research-and-applications programmes

48. In each region, the Centre will prepare and carry out annual education, research-and-applications programmes for university-level educators and research-and-application scientists drawn from the user communities. The duration of each programme will be for a period of nine months. Experts and consultants contributing to the programme will be highly qualified (scientific and technical) individuals from the countries of the region.

49. The number of participants each year will initially be limited to 30; these participants would need the endorsement of their institutions/ Governments and an agreement with the United Nations that their acquired knowledge will be fully utilized on their return to their countries. Assistance will be provided by the Centre to organize follow-up national/local education programmes for other educators and Earth science professionals in the participants' own countries.

50. The programmes will focus on teaching techniques and methods in environmental information systems as applied to educational, environmental and economic development issues. Case studies using remote sensing and meteorological satellite data that can be processed, analysed and stored on microcomputer systems will be prepared in advance to provide hands-on illustrations of applications to (a) specific natural resource surveys, and (b) to specific environmental monitoring and assessment exercises;

51. Participants will acquire knowledge and skills needed to develop and prepare (a) teaching manuals, (b) auxiliary audio-visual materials, (c) research and (d) applications, project proposals and reports.

B. Workshops for secondary and primary schoolteachers

52. Each year, during the school vacation periods, two workshops, each lasting a minimum period of two weeks, will be organized for the benefit of primary and secondary schoolteachers from the region. Participants in these workshops would be exposed to the relevance of remote-sensing technology and other aspects of Earth Observing Systems and in national development and environmental monitoring and to the means and materials through which they could introduce these concepts into the secondary education curricula in their countries.

C. Continuing education programmes

53. The Centre will organize continuing education programmes through workshops for educators and research-and-applications scientists. Such programmes would enable individuals who have participated in this education programme as well as others with similar exposure to remain abreast of advances in the discipline.

D. Pilot projects

54. This phase of the programme of the Centres will concentrate on ensuring that the participants make use of the skills and knowledge gained in the activities described in paragraphs 48 to 51 above.

55. Each Centre will assist participants who have completed this education programme (i) to conduct pilot projects over a full school year and (ii) to introduce the knowledge, skills and experience acquired at the Centre and through the pilot projects in their teaching, research and application activities in their countries. The modules and manuals developed during their stay at the Centre will be tested at the pilot project(s) phase. The experience gained will be used to improve the Centre's programme. Suggested guidelines for defining/executing the pilot projects are contained in annex II to the present document.

E. Data management

56. An integral part of each Centre for Space Science and Technology Education is a Data Management Unit. Through this Unit, each Centre will have direct linkages with existing relevant global data centres and the nearest UNEP/GRID Centres (Nodes). Such linkages will enable those participating in the programmes of the Centres to utilize the data in the archives of the data centres, particularly when undertaking projects that could benefit from such access.

57. As indicated in the list of equipment for each Centre (see annex III), each Centre shall be equipped with an Advanced Very High Resolution Radiometer (AVHRR) receiving station. In addition, each Centre will also be linked with the nearest Earth Observation Ground Receiving Station(s). The data collected from these stations will be used in the activities of each Centre and, where deemed necessary, shall also be part of the Centre's archives.

58. Each Centre will establish a data management programme for the purpose of enhancing the skills of its user community and to provide that community with the capabilities:

(i) To develop guidelines for data collection;

(ii) To standardize their physical and socio-economic data collection process;

(iii) To develop guidelines for data geo-referencing,

(iv) To undertake the integration of socio-economic and biophysical data through GIS;

(v) To establish up-to-date national baseline information;

(vi) To organize continuing education activities for policy/decision makers on the importance of data and its value and relevance in decision-making.

VIII. PERSONNEL, EQUIPMENT, FACILITIES AND BUDGET

59. The personnel, equipment, facilities and other requirements are detailed in annex III to the present document. The budget is set out in annex VI.

60. The funding requirements of each Centre will vary depending on existing infrastructure and the local economic conditions. In the first five years, each of the Centres will require from $6 million to $7.5 million; the breakdown of these figures is contained in the budget (annex VI).

IX. INPUT

61. The sources of support for each Centre are expected to come from (a) the host country, (b) the other countries of the region, (c) donor countries and (d) international funding agencies, including UNDP.

A. Host Government/institution

62. The Host Government will provide the facilities as described in annex II.

63. The Host Government/institution will be responsible for the support and security staff (except the bilingual secretaries) identified in annex III, and any other personnel that may be needed for the normal operation of the Centre.

64. The Host Government/institution will also provide the following:

(i) Assistance to Centre personnel and participants to locate reasonable and affordable housing;

(ii) Salaries of local personnel assigned to the Centre;

(iii) Access to the facilities and expertise of the host institution's computing centre;

(iv) Access to voice and data telecommunication lines from the Centre;

(v) Access to running water, electricity and other infrastructural elements necessary for the operation of the Centre;

(vi) Facilitate the establishment of institutional/working relationship between the Centre and local universities/research centres/user agencies.

The Host Government will waive import fees and licences for equipment and materials required by the Centre.

B. Other participating Governments in the region

65. The Governments of the region in which the Centre is located will provide:

(i) The salaries and benefits to which their personnel are entitled in their home country while they participate in the programme of and are resident at the Centre;

(ii) Health, accident and life insurance for their personnel.

These Governments will also be requested to make:

(i) Voluntary cash contributions to support the activities of the Centre;

(ii) A commitment in the form of an exchange of letters, between the executing agency and the institution/participating Government, to make use of the knowledge acquired by their educator(s) at the Centre, particularly through their participation in the in-country pilot project(s), and to provide all the necessary local support for the successful implementation of the pilot project(s).

C. Sponsors/donors

66. The sponsors/donors will make the following contributions to the project:

(i) The sponsors/donors will support each Centre through cash contributions for the implementation of the Centre programmes that are not covered by the contributions made to the Centre by the host institution, the host Government and other participating Governments;

(ii) The sponsors/donors will make arrangements with their industrial establishments to provide all or part of the equipment listed in annex III. The sponsors and the executing agency will jointly decide on the specifications and acquisition of the equipment;

(iii) A sponsoring/donor Government will facilitate the establishment of close relationships between the Centre and its own relevant centre(s) of excellence. Such relationships will accelerate the development of the programmes at the Centre, enrich knowledge and skills development at the Centre and enhance its credibility both locally and internationally;

(iv) The sponsors/donors will identify and make arrangements for individuals in their research-and-applications institutions (both governmental and private, as well as institutions of higher education), whose expertise can make significant contributions to the Centre. The sponsors/donors will also identify and provide the services of a liaison officer to coordinate and ensure the effective contributions of these institutions;

(v) A sponsor/donor will appoint a representative to serve on the Governing Board of the Centre.

D. United Nations Development Programme

67. The following external inputs are being sought through UNDP for:

(i) Preparatory activities in respect of this project:

(a) To convene three Centre-related regional conferences in Africa (October 1993), Asia (May 1993) and the Middle East (November 1993) (see annex IV). These regional Conferences

will address environmental management and sustainable development issues and the relevant ongoing programmes in the countries of the region. The roles of the countries and related institutions in ensuring the viability of the Centre in each region will be fully addressed. Request for UNDP support for each of these regional conferences is being sought;

(b) To organize and conduct evaluation missions to Africa, Asia and Western Asia in respect of the Centre in each of these regions (see annex V for purpose and terms of reference of each evaluation mission). Request for UNDP support for each of these evaluation missions is also being sought; the mission to Latin America has already been completed.

(ii) Supplementary financial support needed to launch and operate the programme of each Centre. Request from UNDP is $2 million per year for the next five years, i.e. 1993-1997, at the rate of $500,000 per Centre per year (see the budget in annex VI).

X. OPERATION AND MANAGEMENT OF THE CENTRES

68. The Governing Board, the Centre management, the executing agency and the donors/sponsors will share responsibilities in the administration of each Centre. The manner in which each Centre should function is outlined in annex VII.

A. Executing agency

69. The executing agency for the projects will be the Office for Outer Space Affairs (OOSA) of the United Nations, in collaboration with the concerned regional commissions - ECA, ECE, ECLAC, ESCAP and ESCWA - the participating specialized agencies (e.g., FAO, UNESCO, WMO) and UNDP.

70. The executing agency will have responsibility for the supervision of the project. In this regard, the executing agency shall consult with the sponsors on a regular basis. The executing agency will be responsible for the following:

(i) Outlining the terms of reference for the Panel of Experts referred to in phase 2 (see sect. XI.B below);

(ii) Elaborating on the agreement between the executing agency and the host Government/institution, with the advice of the sponsors. This agreement will detail the contributions to be made by each party and their obligations, including the procedure for settlement of disputes and termination of the agreement should this prove necessary. The Office of Legal Affairs of the United Nations shall be the final authority on non-programme related aspects of the agreement;

(iii) Defining the terms of reference for the supply of equipment and materials. These terms of reference will include a description of the microcomputer systems (hardware/software) and their spare parts and maintenance; photographic laboratory equipment and supplies; and specifications of all other essential equipment and materials;

(iv) Ensuring, in cooperation with the Centre, that all reports due are prepared and forwarded to the concerned parties;

(v) Exploring possible avenues within the international community to raise the necessary funds for the establishment and operation of the Centre;

(vi) Helping the Centre to gradually become independent in its operations and administration.

B. The Centre

71. Each Centre will have the following responsibilities:

(i) The Centre will have full responsibility for the development, management and implementation of all its activities, including the education, research and applications programme;

(ii) The Centre will advise its graduates in developing and organizing the pilot projects referred to in paragraph 55. This effort will include the determination of the scope of the pilot projects and the establishment of necessary criteria for evaluating the results of the projects;

(iii) The Centre, in cooperation with the executing agency, will take responsibility for organizing the workshops aimed at evaluating the education programme at the Centre and the results of the pilot projects. This activity will include establishing the workshops' programmes, issuing invitations to participants for the workshop and evaluating the workshops' results. The sponsors/donors will be invited to participate in these exercises;

(iv) The Centre will take responsibility for developing programmes in collaboration with institutions of higher learning in the region, as well as with national and regional remote-sensing user assistance and training centres.

C. The Governing Board

72. The responsibilities of the Governing Board will include the following:

(i) The Governing Board will formulate the broad policies that will govern the activities of the Centre in programmes, personnel and finances;

(ii) Within the first four years of the Centre's operation, the Governing Board will establish an Endowment Fund in order to ensure the financial solvency of the Centre;

(iii) The composition of the Governing Board shall include two representatives who will serve, on a rotating basis, the interests of all the countries of the region, and representative(s) from each of the following:

- The host country/institution;
- Each sponsor/donor;
- The Centre (its Director);
- The executing agency, which will have a maximum of four seats on the Board (one permanent seat each for OOSA, the concerned regional commission and UNDP, and one annually rotating seat among FAO, UNESCO and WMO);

(iv) The Board will invite up to a maximum of four additional, professionally qualified individuals to serve, in their personal capacities, as full members of the Board;

(v) The Board will elect its Chairman and determine the tenure of all of its members, in accordance with standard international procedure;

(vi) In addition to its governing functions, the Board will also function as a Scientific Committee whose responsibilities shall include the regular evaluation and assessment of the work programme of the Centre in order to ensure its commitment to excellence.

D. The Advisory Board

73. The Advisory Board will function in an advisory capacity to the Director, in scientific, technological and educational issues, including the following:

(i) The Advisory Board shall provide advice to the Centre, the executing agency and the Governing Board from time to time;

(ii) Members of the Board will function as ambassadors-at-large for the Centre and shall undertake activities that can enhance the credibility and the financial status of the Centre;

(iii) Members of the Board will be prominent individuals in government, private industry and the academic and scientific communities;

(iv) Members of the Advisory Board will be nominated and voted for by the Governing Board and shall serve for such a period as may be determined by the Governing Board.

XI. STRATEGY FOR IMPLEMENTATION

74. In order to achieve the objectives outlined above, the establishment of each Centre will be implemented in four phases.

A. Phase 1 - preparatory activities

75. The preparatory activities include:

(i) Identification of the host Governments/institutions (see annex VIII for a list of the 23 countries that have offered to host these Centres in five regions);

(ii) Raising the necessary funds and securing technical support to establish the Centres (see annex VIII for the list of potential host countries that have indicated the annual financial offer they are prepared to make to the Centre if it were located in their territory);

(iii) In addition, the Office for Outer Space Affairs has visited 11 industrialized countries and 2 international organizations to seek financial and technical support for the establishment and operation of these Centres;

(iv) The facilities and resources being provided by each potential host Government and institutions shall be evaluated. In this connection, an evaluation mission was conducted in Latin America (Argentina, Brazil, Chile and Mexico) in May 1992. Experts sponsored by the Governments of Canada and Spain, ECLAC headquarters, UNDP in Mexico, the Office for Outer Space Affairs (OOSA) and a consultant recruited by OOSA participated in this mission;

(v) Other evaluation missions are planned for Africa and Asia before the end of 1993. The Government of Germany has officially confirmed to the United Nations its readiness to participate in the mission to Africa.

B. Phase 2 - development activities

76. The first activity in this phase is the establishment of the Governing Board, whose immediate responsibilities will include the following:

(i) Selection of sites for each Centre, setting up of facilities and consolidating financial arrangements;

(ii) Identification and recruitment of the Director and other professional personnel, including visiting scholars within the region and from the international community for the Centres (see annex III);

(iii) Hiring of a group of experts (by the Board) who, in cooperation with the executing agency, will have the following responsibilities:

(a) Assessment of educational levels in each region (e.g., existing university courses and research programmes, audiovisual materials, etc.);

(b) Development of each Centre's curriculum on the basis of the assessment in (a) above; a model curriculum is shown in annex IX;

(c) Identification and acquisition as well as development of scientific and technical education materials appropriate for the Centre in each region;

(d) Specification, acquisition and installation of equipment and laboratory facilities (see annex III) and the hiring and training of support personnel in the use and maintenance of the equipment and facilities.

C. Phase 3 - operational phase

77. This phase will focus on the operational aspects of the Centre and will include the following:

(i) The Centre will organize and implement the education, research and application programmes for natural, physical and environmental science educators and research-and-application scientists;

(ii) The Centre will organize workshops for secondary and primary schoolteachers;

(iii) The Centre will provide research, education and application support services for national and regional institutions;

(iv) The Centre will organize a continuing education programme at each Centre for educators and research-and-application scientists, including the Centre's graduates;

(v) The Centre will extend invitations to Member States to nominate qualified candidates from their academic and research institutions and user agencies to participate in the various programmes of each of the Centres.

D. Phase 4 - practical realization

78. Graduates of the Centres will:

(i) Return to their countries to implement pilot projects;

(ii) With the aid of the materials developed at each Centre, introduce the knowledge acquired into the education curricula and research-and-application activities in their own and other institutions in their country and region.

Each Centre shall organize evaluation workshops that will assess each participant's pilot project and provide feedback on the efficacy of each Centre's education, research and application programmes.

XII. PARTICIPATION: REQUIREMENTS AND OBLIGATIONS

A. Requirements for participation

79. Qualifications. The responsibility to nominate qualified candidates to participate in the programmes of each Centre will rest in each country and its institutions. Since the initial focus of each Centre will be on developing and enhancing the knowledge and skills of these participants in natural resources management and environmental assessment, such nominees should be individuals that have received their graduate and undergraduate education in any of the established disciplines in these areas. Candidates from application-oriented agencies should have a minimum education equivalent to a Bachelor's degree in the aforementioned discipline and a minimum of five years of practical postgraduate experience in an established user institution/agency in their own countries. Candidates from research and educational institutions should have a minimum of a Master's degree in natural, physical and/or environmental sciences and should also have a minimum of five years of practical/working experience in the institutions of their countries following their graduation. Candidates with doctorate degrees should have a minimum of three years of practical/working experience in natural, physical or environmental sciences in the institutions of their countries.

80. Screening of candidates at the national level. In order to present candidates for consideration for admission to the programme of each Centre,

each country would need to establish a local mechanism for screening its applicants. It would be the responsibility of each country to ascertain that the established prerequisites have been met by the candidates nominated for admission to the programme of each Centre. Each Centre reserves the right to accept or reject the application of any candidate forwarded by any country for its consideration. While a basic knowledge of remote sensing/satellite meteorology is desirable, it is however not mandatory.

B. Obligations of each participant and his/her country

81. The overall goal of the programmes of each Centre is to assist participating Member States to develop and enhance the knowledge and skills of their citizens in relevant aspects of space science and technology as outlined in annex IX of the present report. Accordingly, at the inception of each Centre, each Member State will exchange a Memorandum of Understanding with the United Nations and the Governing Board of each Centre. Such a Memorandum of Understanding will, among other things, specify the following:

(i) The entitlements that a participant had before being admitted to the Centre will be honoured by the nominating institution/country for the duration of his/her participation in the Centre's programme;

(ii) At the completion of his/her participation in the Centre's programme, each participant shall return to his/her country, where he/she should be assisted to make effective use of the knowledge and skills gained at the Centre through his/her contributions to teaching, research and execution of applications projects and public education programmes. Such an approach should lead to the development of the capacities detailed in paragraph 45 above;

(iii) The aforementioned participant will remain in such a position with commensurate and progressive remuneration and other entitlements for a minimum period of service, to be determined by the Governing Board of each Centre;

(iv) The country of each participant will commit itself to supporting the professional activities of the participant in his/her country following completion of the Centre's programme. Such support will include but not be limited to the provision of:

(a) Necessary infrastructure, including essential office and laboratory space and equipment;

(b) Support staff;

(c) Necessary operating costs, including those associated with the purchase of consumable goods, necessary literature, transportation and participation in local, regional and international professional conferences, etc.

C. Responsibilities of Member States of each region

82. In order to ensure the financial viability of each Centre, all the countries within the operating sphere of a given Centre for Space Science and Technology Education should consider it their responsibility to the Centre to make annual financial contributions to the Endowment Fund (see para. 72 (ii) above) of the Centre in their region.

XIII. PRIOR OR ONGOING REGIONAL PROGRAMMES

83. There do not currently exist any prior or ongoing programmes that provide in-depth educational opportunities as contained in the present project proposal.

84. The existing regional remote-sensing training centres in Africa (Nairobi, Ile-Ife (Nigeria), Ouagadogou), Latin America (Santa Fe de Bogota, Colombia) and Asia (Bangkok) were established to provide the following services for their member States: (a) services in surveying, mapping and remote sensing; (b) training for junior- and middle-level technicians in surveying, mapping and remote sensing; and (c) distribution of data and results of studies, research and tests carried out by these centres. Most of these centres provide short-term training courses for the personnel described in (a) above from user agencies (see para. 46 (i) above) of the countries they serve. In general, most of the participants in these activities have obtained their first degree; others have their technical diplomas.

85. The graduates of existing training and user assistance centres and those of the planned Centres can collaborate on major research-and-application projects for the betterment of their countries. Because of their higher analytical skills, the graduates of the planned Centres should be able to strengthen the capabilities of institutions of higher learning and existing national and regional remote-sensing user assistance and training centres and thereby enhance the capabilities of the countries and regions they serve, and subsequently contribute effectively to national, regional and international environmental monitoring and natural resources management programmes.

Notes

1/ Report of the World Commission on Environment and Development, "Our Common Future", A/42/427, annex. Also available as: World Commission on Environment and Development, Our Common Future (Oxford University Press, 1987).

2/ See Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 3-14 June 1992) (A/CONF.151/26).

3/ Ibid., chap. I.1, annex II, sect. 1, para. 7.29.

4/ Ibid., para. 7.33.

Notes (continued)

5/ Ibid., sect. II, para. 14.41 (a).

6/ Ibid., para. 18.14.

7/ A/C.2/44/11, annex, paras. 33 and 34.

8/ Program on Environment Information Systems in Sub-Saharan Africa: Status of the Program. Third meeting of the Advisory Committee, Heidelberg, Germany, April 10-12, 1991. Environment Division, Africa Technical Division, The World Bank, August 1991, p. 7.

9/ Ibid.

10/ Ibid., pp. 2 and 3.

11/ Commission of the European Communities, Directorate General VIII - Joint Research Centre, Ispra Establishment. Remote Sensing of the Sahelian Environment: A review of the current status and future prospects, by S. D. Prince, C. O. Justice and S. O. Los. CTA/CEE, 1990, p. 12.

12/ Ibid., pp. 69 and 70.

13/ A/42/427, annex, chap. 4, paras. 68 and 69.

14/ See Report of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, 9-21 August 1982 (A/CONF.101/10 and Corr.1 and 2), part one.

15/ A/AC.105/456, annex II, para. 4 (n).

Annex I

ACTIVITIES CONDUCTED BY THE UNITED NATIONS SPACE APPLICATIONS PROGRAMME IN THE PERIOD 1983-1991 FOLLOWING UNISPACE 82 RECOMMENDATIONS AND GENERAL ASSEMBLY RESOLUTION 37/90

UNISPACE 82 RECOMMENDATIONS MANDATED THROUGH RES 37/90	NUMBER OF ACTIVITIES	NUMBER OF PARTICIPANTS FROM DEVELOPING COUNTRIES	NUMBER OF APPLICANTS
(1) PROMOTION OF GREATER EXCHANGE OF ACTUAL EXPERIENCE IN SPACE SCIENCE AND TECHNOLOGY	10	375 CO-SPONSORSHIP OF COSPAR, IAF & ISPRS MEETINGS AND CONGRESSES	BY INVITATION
(2) PROMOTION OF GREATER CO-OPERATION IN SPACE SCIENCE AND TECHNOLOGY	14	345 MEETINGS OF EXPERTS	752
(3) FELLOWSHIP PROGRAMMES FOR IN-DEPTH TRAINING	10 TYPES OF PROGRAMMES /YR	102 LONG-TERM FELLOWSHIPS (AUSTRIA, BRAZIL, CHINA, ESA, USSR)	675
(4) ORGANIZATION OF COURSES/WORKSHOPS ON ADVANCED SPACE APPLICATIONS AND NEW SYSTEM DEVELOPMENTS FOR SPECIALISTS, MANAGERS AND DECISION MAKERS	32	535 COURSES, SEMINARS & WORKSHOPS, 1-5 WEEKS IN DURATION	1531
(5) STIMULATION OF THE GROWTH OF INDIGENOUS NUCLEI AND AN AUTONOMOUS TECHNOLOGICAL BASE IN SPACE TECHNOLOGY	4	183 MEETINGS OF EXPERTS; EDUCATION TOPICS (INDIA, MEXICO, NIGERIA, UK)	355
(6) ACQUISITION AND DISSEMINATION OF INFORMATION IN SPACE SCIENCE AND TECHNOLOGY AND ITS APPLICATIONS	2*	95 (FROM BOTH INDUSTRIALIZED AND DEVELOPING COUNTRIES)	BY INVITATION
(7) TECHNICAL ADVISORY SERVICES IN SPACE APPLICATIONS PROJECTS	7	13 COUNTRIES VISITED, 7 CONSULTANCIES PROVIDED	ON REQUEST

* As follow-up to the recommendations of these meetings, the programme has published the following documents: (a) "Education, Training, Research and Fellowship Opportunities - A Directory" (A/AC.105/366 and A/AC.105/366/Add.1; The latest edition in this series is A/AC:105/522); (b) Information Systems on Space Science and Technology: A Directory (A/AC.105/397; The latest edition in this series is A/AC.105/517).

Annex II

Suggested Guidelines for Defining/Executing "Pilot Projects"

1. Pilot projects should emphasize the theory and applications of Earth Observation Systems (remote sensing and satellite meteorology), enhanced whenever possible with both research and applications experiences.

2. Each educator or research/application scientist participating in the programme of the Centre will be a Principal Investigator (PI). Prior to the beginning of the pilot project, each PI will submit to the Centre a project proposal identifying the project objectives, methods, materials to be used and their associated costs, schedule of work, and co-operating individuals and agencies.

3. The pilot projects will be either of an educational or research/applications nature.

4. Participants whose main activity in their countries is teaching will submit a pilot project proposal containing an outline of the specific courses which they teach and identify the areas in which, in their a priori understanding, they would be able to introduce their acquired remote sensing skills and knowledge.

5. During the nine-month programme, the Centre will assist these participants to refine their proposal, prepare teaching guides and educational materials. The materials that these participants will develop at the Centre will include audio-visual materials, practical exercises and demonstrations of analogue and digital image processing and analysis as well as instruction in the use of geographic information systems for applications in the specific subject area being taught.

6. When the projects include a research/applications component, existing (archive) data should be utilized where possible in order to reduce cost and technological risk as well as expedite the data acquisition process.

7. Only manageable, discrete test sites should be used; these should be of sufficient area needed to establish the "proof-of-concept", but without placing undue demand on the image analysis equipment, staff and other resources.

8. The proposals from the PIs will be reviewed and approved by the Centre's personnel assisted by external assessor(s).

9. The Centre will:

- review, suggest modifications to, and accept the proposals;
- monitor the progress of the execution phase of the project;
- provide technical consultative advice to the PIs;
- act as a "peer review" for the final reports as well as provide guidelines on the format of the final reports;
- make recommendations to improve the project administration process.

10. The PIs of pilot projects which extend beyond one year duration should submit annual progress reports to the Centre.

11. The Centre shall act as an intermediary between the PIs (and their "operational" results), and the various government departments who can potentially use the demonstrated technology.

Annex III

PERSONNEL, EQUIPMENT AND FACILITIES

A. Personnel

1. Specialists and experts who are capable of contributing to the implementation of the programmes of the Centres will be drawn from the academic, research and applications communities, both locally and abroad.

2. Each Centre shall be headed by a Director. The resident staff of each Centre will be small and will be complemented by visiting scientists both locally and from abroad. Because each Centre will be housed in a major science and technology oriented university or research institution, such an arrangement will enable the Centres to optimally utilize the existing professional staff and the physical infrastructure at their respective host institutions. The responsibilities of all these individuals are described below.

(i) Centre's Director: (Research and Education Expert):

The Centre will be directed by a senior highly qualified scientist with extensive experience in the development and use of environmental information systems, particularly remote sensing, satellite meteorology and geographical information systems. This individual should also have wide experience in research, teaching and applications in these fields, and should be familiar with institutions and organizations of higher education in the region and internationally.

(ii) Scientific/Technical Personnel:

(a) The programme of each Centre will require the services of an adequate number of scientific/technical environmental information system experts with experience in research, teaching, application programmes, curriculum development and education administration.

(b) In addition, each of the countries of the region as well as sponsoring countries/agencies of each Centre, shall identify and make arrangements for participation by individuals in their education, research and applications institutions (both governmental and private), whose expertise including education, research and practical experience in remote sensing and related application technologies e.g. GIS, and who can contribute to the programmes of the Centre

concerned. The sponsors will also identify and provide the services of a liaison officer to coordinate and ensure the effective contributions of these institutions and individuals.

The responsibilities of the experts in (ii) above will include:

(a) the development of methodologies for integrating the elements of environmental information systems (such as remote sensing, satellite meteorology and GIS) into the education curricula at the primary, secondary and university levels;

(b) conducting an inventory and an evaluation of educational materials related to environmental information system in each region; and

(c) teaching and research activities at the Centre.

(iii) Technical Personnel (Three):

The main tasks of the technical officers will include:

(a) Maintenance and supervision of field equipment and laboratory facilities;

(b) provision of logistical support for meetings, research work and field exercises; and

(c) provision of photographic and darkroom services.

(iv) Administrative Personnel:

The responsibilities of the administrative section will include the following:

(a) administration and management of the finances of the Centre;

(b) supervision of purchases and control of inventory of supplies (stationery, audio-video materials and equipment, etc); and

(c) air travel/hotel arrangements.

(v) Support Staff:

(a) Two secretaries with international work experience; one of them shall be bilingual in this case, the language requirement shall be determined by each Centre.

(b) The Host Government/institution will provide, at

its own expense, two additional full-time secretaries for the use of each Centre.

(c) Two full-time drivers/mechanics.

(vi) Security:

The Host Government/institution will make security arrangements for the Centre and shall provide necessary personnel for this purpose. Such personnel shall report to the Director of the Centre.

B. **Facilities**:

3. The following facilities are required for each Centre:

(i) Classrooms, computer room, working areas, and a conference room with facilities for audio-video presentations, as well as access to the libraries of the host institution for all Centre personnel, consultants and visiting scientists;

(ii) Office space for each of the permanent Centre personnel and consultants. The host institution shall also provide reasonable office space for use by visiting educators;

(iii) Secure storage areas for equipment, general supplies, documents, maps and other materials;

(iv) Adequate accommodation for two technical/education laboratories;

(v) One dark room for photographic processing;

(vi) Adequate space to be used as the Centre's library; the latter shall contain books, audio-video teaching aids, selected journals, etc. The Centre will operate bibliographic referral services and provide, where possible, limited copies of materials on a "cost" basis; and

(vii) Access to international and national communication networks.

C. **Equipment**:

4. The following are the equipment requirements of each Centre:

(i) Twenty microcomputer systems; six of these should have the potential for handling geographic information systems and relevant computer software for image analysis

(ii) 2 multi-channel radiometers for ground surveys

(iii) Photographic cameras (2) 35 mm

(iv) 35 mm slide-projectors (3)

(v) Overhead projectors (3)

(vi) Video cassette recorders (2); colour T.V. set (2)

(vii) Office supplies

(viii) Projection screens (2)

(ix) Photographic supplies

(x) Drafting supplies and lettering equipment

(xi) Voltage regulators

(xii) Dark room equipment

(xiii) Audio cassette tape recorders (2)

(xiv) A photo-copying machine

(xv) Office furnishings

(xvi) A small scale meteorological satellite receiving station

(xvii) Satellite remote sensing images and air photographs

(xviii) Three vehicles (2 field vehicles (Jeeps) and a car)

(xix) Laboratory stereoscopes (17)

(xx) Portable independent communication equipment for voice and data transmission/reception

(xxi) Replacement parts, and other consumables, for the equipment listed above.

Annex IV

Information Sheet

UNITED NATIONS REGIONAL CONFERENCES ON ENVIRONMENTAL AND NATURAL RESOURCES INFORMATION AND MANAGEMENT NEEDS

A. Objective

1. The objectives of these Conferences are to evaluate and develop plans that would focus on how relevant aspects of space science and technology with particular emphasis on environmental and resource information systems, can be directed towards the solution of regional resource management problems, the safeguarding of the environment, and regional social and economic development. In this context, each Conference will review the recommendations of the United Nations Conference on Environment and Development (UNCED) held in Rio in June 1992 and its Agenda 21, including the initiatives to implement those elements that are relevant to each region. Specifically, each Conference shall, among other things,

(i) assess the social and economic impact and implications of current and future developments in space science and technology;

(ii) assess each region's environmental and natural resources information needs that can be met from a variety of sources including those from space platforms;

(iii) assess each region's readiness, through its regional/national institutions, to meet the challenges of (i) and (ii) above, and develop programmes that can enhance the capabilities of these and any other viable institution(s);

(iv) examine current space application initiatives, particularly in environmental and natural resources information systems that are being developed for each region, and evolve a plan that will ensure the region's participation in those activities that offer realistic benefits for its Member States, including such global programmes as Mission to Planet Earth, International Geosphere-Biosphere Programme and Landsat Pathfinder Tropical Deforestation Project which could provide a better understanding of problems such as desertification, changing climate, deforestation, ocean productivity; and

(v) develop a coherent programme, with due consideration being given to the recommendations of UNCED, including its Agenda 21.

B. Background

2. At present, most countries routinely receive analogue data (through Automatic Picture Transmission stations (APT)) and digital data (through Weather Facsimile (WEFAX) stations) of their specific geographical area from polar-orbiting and geostationary meteorological satellites.

3. Today, an array of Earth observation satellites for meteorological and marine observations, as well as for earth resources surveys, provide copious environmental and natural resources information. The need for Member States to participate in the application of such information for their social and economic development have resulted in the establishment of a number of regional remote sensing programmes/centres such as the Regional Remote Sensing Programme at ESCAP Headquarters in Bangkok, the Indian Remote Sensing Institute in Dehra Dun, the Regional User Assistance and Training Centres in Nairobi (Kenya), Ouagadougou, (Burkina Faso) and Ile-Ife (Nigeria) and the Instituto Geográfico Agustin Codazzi (IGAC) in Bogota, Colombia.

C. Justification for the proposed Conference

4. Remote sensing technology has become operational, and it is being applied to improve the knowledge of the natural resources of many nations, to provide information necessary for the sustainable development of these resources and to assist in preventing or redressing damages to the Earth's environment. Indeed, it is being amply and continuously demonstrated, through a variety of projects, that it can contribute significantly to the achievement of the economic and social development goals of a nation. Environmental and natural resources data of different parts of the world are being observed daily by an array of earth orbiting satellites and manned-space vehicles. This process will continue to be intensified. And for a long time to come, space borne sensors may be the main source of reliable data on the environment and natural resources of most countries. The availability of such data sets can assist these countries to better understand and safeguard their environment as well as ensure a more efficient management and productive harnessing of their natural resources. Although earth receiving stations are located in many parts of the world, however, Earth observation data from extensive areas (over 70%) of Africa, all of the Caribbean, and significant portions of the Pacific remain unrecorded daily since these areas are not covered by any stations and most of the operating Earth observation satellites have no on-board recording systems.

5. Today, the pace of remote sensing development and utilization in several developing countries lags far behind similar efforts in any other region of the world. Because of the absence of qualified human resources at the local level, many national/local authorities are often not capable to deal with the very abundant digitized

satellite-derived data and information from existing space-borne sensor systems. Thus, many of the on-going activities and projects in these countries are being undertaken through foreign consultants/contractors. Accordingly, opportunities that could have contributed to indigenous capability development within the continent are lost. A major attendant problem is the lack of direct application and use of these data by government agencies and by personnel responsible for extension services and for environmental management, agricultural development and related issues. Remote sensing science should be integrated into the educational and research programmes of the institutions in these countries.

6. In a recent analysis that focused specifically on Africa, the World Bank concluded "that if Africa is to benefit from advances in information systems and other sciences and technologies, including remote sensing and its environmental application potentials, it must improve its science and technology training and aim at the highest standards for at least a minimum core of specialists. Foreign aid should go towards building excellence and relevance in science and technology and helping to link institutions to others outside Africa. Such new institutions should match science and technology with economic and social development by establishing effective relationship between teaching, research and delivery services." Within varying degrees the same can be said of other regions in the developing world.

7. Within the global community, fellowships are being provided and short-term training courses are being organized for education and training in relevant institutions, particularly in the industrialized countries, to meet these needs. However, the needs of many developing countries far exceed current capabilities. In addition, the short term courses are mostly application-oriented; they are generally conducted abroad, thus only very few individuals from a given developing country can participate in them. In these countries, there are a number of on-going remote sensing projects that are being sponsored by different entities to address immediate needs. By their very nature, these projects are supply-driven, application-oriented, and external assistance dependent; local talents cannot readily participate in them because of their limited knowledge of the technology that is being applied. The development of indigenous capability in any discipline certainly requires the marshalling of well-educated human resources at the local level. Given the several entities involved in these supply-driven proposals and programmes, and the potential impact of the latter on each region's social and economic development, one is forced to ask a multitude of questions such as: The need for consultation with beneficiaries? Consolidation and coordination of these activities?

8. Globally and on each passing day, the inter-relationship between the state of the Earth's atmosphere and the welfare of mankind here on Earth is causing concern. There are many major

global environmental and resource development issues that are now being planned and in which remote sensing technology would serve as a significant and necessary tool. Specifically, the international community is now embarking on long-term programmes such as Mission to Planet Earth whose objective is to understand how our planet Earth works and what its future might be as a result of human activities that are altering the natural balances within the planet. Also receiving global attention is the International Geosphere-Biosphere Programme, whose objective is to describe and understand at least within a fifteen year period, beginning in 1990, the interactive processes influenced by human activities. These programmes and others such as the Landsat Pathfinder Tropical Deforestation, will rely heavily on Earth's environmental data being acquired by a variety of space sensor systems. The global community including the developing countries continues to experience major environmental problems (such as locust infestation, deforestation, flooding, soil erosion, drought and desert encroachment and pollution of the environment); the developing countries would need to contribute its share to the solution of these problems and related global programmes.

9. The manner in which each country/region could contribute to the solution of the issues and problems identified above and others that are regional and/or country specific will be addressed explicitly by each Conference. One main source of such contributions is the planned **Centres for Space Science and Technology Education.**

10. In this connection, on 11 December 1990, in its resolution 45/72, the United Nations General Assembly, in recognition of the above situation, endorsed the recommendation of its Committee on the Peaceful Uses of Outer Space (COPUOS) that "... the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional **Centres for Space Science and Technology Education** in existing national/regional educational institutions in the developing countries." Twenty-three countries have officially informed the United Nations of their intention to host these Centres; these are: Africa (Ghana, Kenya, Morocco, Nigeria, Senegal and Zimbabwe), Latin America (Argentina, Brazil, Chile and Mexico), Asia (China, India, Indonesia, Iran, Malaysia, Pakistan, Sri Lanka and Thailand), Middle East (Jordan, Syria, United Arab Emirates and Oman), and Europe (Greece).

11. Each Conference will be fully briefed about the roles of the planned Centres for Space Science and Technology Education in addressing environmental and natural resources information and management needs in each region, and the efforts undertaken to-date to ensure its establishment in that particular region. The Conference will also address the roles of all the Member States in each region and their related institutions in ensuring the viability of the Centre.

D. The organization of, and participation in the Conference (sponsorship, location, time, duration and participation)

12. Time and Duration: These conferences are proposed to be held in 1993, each for a five-day working period (one week). The planned Second Space Conference of the Americas to be held Santiago, Chile (26-30 April), and the planned United Nations Regional Conferences to be held in Bandung, Indonesia (17-21 May 1993), Africa (October 1993) and Middle East (November 1993) shall be venues for implementing the contents of this annex.

13. Organization: The organization of this Conference shall be jointly undertaken by the host country, the concerned Regional Economic Commission, the United Nations (OOSA) and interested multilateral and bilateral donor agencies.

14. Level of Participation: Participation in this Conference shall be limited to (a) representatives at the highest managerial (i.e. Permanent Secretaries) and national advisers level. Such representatives shall be from (i) science and technology, (ii) natural resources and environment, and (iii) national planning communities.

15. Those invited: Invitations for participation in this Conference shall be extended to (i) all Member States of each region, (ii) appropriate international and regional organizations, (iii) relevant departments and agencies within the UN system, (iv) relevant private corporations and companies, (v) specific individuals who can contribute to the deliberations of the Conference.

E. Conference Programme

16. Upon consultation with the concerned Regional Economic Commission and the host country, the Office for Outer Space Affairs of the United Nations shall propose a conference programme for the consideration of these and other interested parties. The Conference programme shall address, inter alia, Agenda 21 of UNCED, current and future trends in Earth observation sciences with particular emphasis on environmental and natural information systems as essential tools for promoting socio-economic development and for enhancing national/regional cohesion. Applications of such information to the management of agriculture, water, coastal and marine, and forest resources, weather forecasting, land use and soil erosion will receive special attention. The Conference will also address possible programmes and space-related opportunities for mitigating natural disasters such as those that have ravaged each region in recent decades. Needed capabilities including educational infrastructure should be an essential part of the programme. Analysis of on-going projects and pending initiatives, and the possibilities of their consolidation will be examined. The need to establish cooperation and coordination within each region

and among its Member States particularly within the framework of UNCED and other related regional mandates shall be a priority of the Conference.

F. Funding

17. Each regional economic commission, the host country, and the United Nations (OOSA) shall jointly plan the fund-raising campaign. Funding for this Conference shall be sought from sources jointly identified by these three parties.

G. Exhibits

18. The international community shall be invited to mount exhibits that are in conformity with the objectives of each Conference.

H. Follow-up

19. The host country, the concerned Regional Economic Commission and the United Nations (Office for Outer Space Affairs) and other appropriate entities agreed to at the Conference shall constitute a committee that would oversee the implementation of the recommendations of this Conference.

Annex V (a)

CENTRES FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION

Terms of Reference for Evaluation Missions

Mission objective:

The purpose of this mission (one mission to each regional Economic Commission) is to provide an accurate and informative report that could assist in the selection of the host institution(s) for the regional Centre. The report of the mission should contain sufficient indications of whether the governments and host institutions visited will provide the support necessary for the Centre's successful establishment and sustained operation.

Duration of the mission: 2-3 days for each country

Starting date: To be determined following confirmation of participation by potential donors.

Pre-mission requirements:

Prior to the commencement of the mission, members of the mission team should familiarize themselves with the contents of the project document, general background information on each country, and other relevant materials to be provided by the United Nations Office for Outer Space Affairs. On arrival in each country, the mission should visit the UNDP Resident Representative for appropriate briefings on the potential host country.

Output of the mission and indication of the elements or items to be covered:

A. National level

A.1 Economic and social aspects

1. The overall current economic and social situation of the country should be reviewed. Subsequently, the sectors related to the Centre (environment, science and technology, agriculture, natural resources and education) should be analyzed in terms of their socio-economic status and priority in the national development plan. The role of the Centre within these sectors should be discussed.

2. The economic and social analysis should include a consideration of the present and future functions of the Centre and an analysis of the economic benefits such as employment or stimulation of other industries in the countries of the region.

A.2 Policy aspects

1. An analysis of the policy aspects should focus on the policies of the potential host institution or country which may affect the feasibility of the Centre. Specifically, such an analysis should address legislative, institutional and administrative measures needed for the successful establishment and operation of the Centre.

2. In consideration of the multinational characteristics and regional functions of the Centre, the Government's foreign policy toward other countries, particularly within the region, a situation which might affect the ultimate feasibility of the project, should be taken into account.

3. The relevant sector policy papers which are included in the national development plan should be studied in order to analyze the host country's strategies in these areas. (Background papers will be obtained and circulated to all members of the mission before the visit).

B. Institution Level

B.1 Financial aspects

1. The necessary financial information on the host institution should be obtained; this should include annual capital budget, operating budget and annual revenues, sources of financing and general conditions governing availability of funds from sources of finance.

2. Furthermore, the financial support that the host institution is capable of providing for the sustained operation of the Centre will be analyzed and discussed, taking into account the expected development of the Centre.

3. In-kind support; the mission should determine the availability of in-kind support for the establishment and sustained operation of the Centre.

B.2 Professional and technical aspects

1. The mission should obtain detailed information on the professional and technical background and characteristics of the host institution, including the type and scope of academic programmes, academic level of teaching staff, their accumulated experience in remote sensing education, professional background of

the technical supporting staff, specifications of equipment available, communication facilities and layout of buildings and other infra-structure, etc.

2. The availability of space-related facilities, equipment and technical support necessary for, or complementary to the operation of the Centre will be evaluated in accordance with the requirements described in the project document (SAP/90/001-004).

B.3 Managerial aspects

The mission should address the administrative and financial management issues of the Centre, and the relationship that should evolve between the host institution and the Centre. The degree of autonomy of the Centre should be fully addressed.

B.4 Organizational aspects

The mission should also focus attention on the internal administrative structure of the host institution. The analysis of the latter should cover such questions as organizational set-up, the expediency with which the Centre would be able to conduct its day-to-day operations, its relationship to relevant ministries or other collaborating agencies, lines of command and delegation of authority.

B.5 Operational aspects

The mission should obtain detailed information on the local availability and adequacy of such elements as materials (consumables and non-consumables), utilities, labour and services.

Annex V (b)

Centre for Space Science and Technology Education

EVALUATION MISSION

Agenda

1. Introductory presentation by the mission on the concept of the Centre; this would be followed by the views of the local authorities and a general discussion.

2. Visit to the facilities proposed to house the Centre as well as those to be used by the Centre.

3. Detailed discussions on the issues that follow,

   (a) Institutional support

      (i) The commitments that would be made and agreements that could be entered into, regarding the physical areas, equipment and furnishings that would be provided for the Centre; these would include both those for exclusive use of the Centre and those to which the Centre would have access in conducting its activities;

      (ii) The professional and technical support that could be provided or available in support of the educational activities of the Centre. This would include the possibilities of local visiting professors and technical support for the operation and maintenance of laboratory and computing equipment;

      (iii) Budgetary support for the Centre including its source(s) and possible mechanisms for its allocation and exercise; and

      (iv) Hospitality, counselling and other support to be provided for participants, foreign staff and visiting professors.

   (b) Governmental support

      (i) Facilities for foreign staff and visiting professors to legally work in the Centre;

      (ii) Facilities for visas for participants in the education programme;

      (iii) Facilities to import equipment, supplies and consumable materials that may be necessary for the establishment and operation of the Centre; and

(iv) Budgetary support for the Centre including its source(s) and possible mechanisms for its allocation and exercise.

(c) Establishment of the Centre; funding and legal structure

(i) Character and legal status of the Centre;

(ii) Creation of a trust fund to receive and administer the funds for the establishment of the Centre;

(iii) Mechanism for transfer of funds and authority to the Centre for its eventual autonomous administrative functioning;

(iv) Establishment of Governing and Advisory Boards for the Centre;

(v) Discussion of appropriate salary levels for the staff and visiting professors of the Centre in order to determine an approximate operating budget for the Centre;

(vi) Possible funding sources for the establishment and operation of the Centre (local, regional, potential donors and international organizations).

(d) Practical matters

(i) Availability and range of rents for one- to three-bedroom housing for foreign staff and visiting professors;

(ii) Local availability of equipment, supplies and repair and maintenance services.

The above proposal by the United Nations is an open agenda containing the issues that the mission would highlight. It is intended that this proposal serve as guide for the potential host Governments and institutions in preparation for the visit of the mission and the subsequent discussions. The specific schedule of visits, interviews with various authorities and schedule of discussion meetings would be prepared by the local authorities.

The work of the mission in each country should begin and end with a meeting that would be attended by representatives of all entities which could play a role in the establishment of the Centre in the country being visited. In a similar spirit, the mission will be prepared to include in its discussions other issues that may be proposed by the local authorities in connection with the establishment of the Centre.

Annex VI (a)

Estimated Budget

Africa

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotals
Preliminary Activities	(72,000)	(9,000)	(0)	(0)	(0)	(81,000)
Implement Phase I activities	60,000					60,000
Regional inventory	12,000	9,000				21,000
Infrastructure	(300,000)	(93,600)	(33,600)	(33,600)	(33,600)	(494,400)
Equipment/Laboratories	207,600	66,000	6,000	6,000	6,000	291,600
Office/Classroom furnishing	48,000	6,000	6,000	6,000	6,000	72,000
Library	14,400	4,800	4,800	4,800	4,800	33,600
Consumables	24,000	10,800	10,800	10,800	10,800	67,200
Service and maintenance	6,000	6,000	6,000	6,000	6,000	30,000
Staff	(364,800)	(549,000)	(544,000)	(539,000)	(534,000)	(2,530,800)
Consultants	55,200	45,000	40,000	35,000	30,000	205,200
Project personnel (full-time)	194,400 (6 months)	388,800	388,800	388,800 -	388,800	1,749,600
Instructors	115,200	115,200	115,200	115,200	115,200	576,000
Participants	(328,000)	(400,000)	(400,000)	(400,000)	(400,000)	(1,928,000)
Air travel	72,000	72,000	72,000	72,000	72,000	360,000
Living expenses	256,000	256,800	256,000	256,000	256,000	1,280,000
Pilot project support		72,000	72,000	72,000	72,000	288,000
Associated activities	(18,000)	(108,000)	(90,000)	(90,000)	(90,000)	(396,000)
Development of educational modules	18,000	24,000	6,000	6,000	6,000	60,000
Workshop (primary/ secondary level)		84,000	84,000	84,000	84,000	336,000
Internal activities	(48,000)	(144,000)	(48,000)	(144,000)	(48,000)	(432,000)
Evaluation Workshops		96,000		96,000		192,000
Review Board sessions	48,000	48,000	48,000	48,000	48,000	240,000
Data Management Unit		(170,000)	(120,000)	(120,000)	(120,000)	(530,000)
Equipment/Communications		100,000	50,000	50,000	50,000	250,000
Data and Operation		70,000	70,000	70,000	70,000	280,000
	1,130,800	1,473,600	1,235,600	1,326,600	1,225,600	6,392,200

Annex VI (b)

Estimated Budget

Asia and the Pacific

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotals
Preliminary Activities	(72,000)	(9,000)	(0)	(0)	(0)	(81,000)
Implement Phase I activities	60,000					
Regional inventory	12,000	9,000				
Infrastructure	(300,000)	(93,600)	(33,600)	(33,600)	(33,600)	(494,400)
Equipment/Laboratories	207,600	66,000	6,000	6,000	6,000	291,600
Office/Classroom furnishing	48,000	6,000	6,000	6,000	6,000	72,000
Library	14,400	4,800	4,800	4,800	4,800	33,600
Consumables	24,000	10,800	10,800	10,800	10,800	67,200
Service and maintenance	6,000	6,000	6,000	6,000	6,000	30,000
Staff	(367,800)	(552,000)	(547,000)	(542,000)	(537,000)	(2,545,800)
Consultants	55,200	45,000	40,000	35,000	30,000	205,200
Project personnel (full-time)	194,400 (6 months)	388,800	388,800	388,800 -	388,800	1,749,600
Instructors	118,200	118,200	118,200	118,200	118,200	591,000
Participants	(376,800)	(448,800)	(448,800)	(448,800)	(448,800)	(2,172,000)
Air travel	54,000	54,000	54,000	54,000	54,000	270,000
Living expenses	322,800	322,800	322,800	322,800	322,800	1,614,000
Pilot project support		72,000	72,000	72,000	72,000	288,000
Associated activities	(18,000)	(84,000)	(66,000)	(66,000)	(66,000)	(300,000)
Development of educational modules	18,000	24,000	6,000	6,000	6,000	60,000
Workshop (primary/ secondary level)		60,000	60,000	60,000	60,000	240,000
Internal activities	(36,000)	(108,000)	(36,000)	(108,000)	(108,000)	(396,000)
Evaluation Workshops		72,000		72,000	72,000	216,000
Review Board sessions	36,000	36,000	36,000	36,000	36,000	180,000
Data Management Unit		(170,000)	(120,000)	(120,000)	(120,000)	(530,000)
Equipment/Communications		100,000	50,000	50,000	50,000	250,000
Data and Operation		70,000	70,000	70,000	70,000	280,000
	1,170,600	1,465,400	1,251,400	1,318,400	1,313,400	6,519,200

Annex VI (c)

Estimated Budget

Latin America and the Caribbean

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotals
Preliminary Activities	(72,000)	(9,000)	(0)	(0)	(0)	(81,000)
Implement Phase I activities	60,000					60,000
Regional inventory	12,000	9,000				21,000
Infrastructure	(300,000)	(93,600)	(33,600)	(33,600)	(33,600)	(494,400)
Equipment/Laboratories	207,600	66,000	6,000	6,000	6,000	291,600
Office/Classroom furnishing	48,000	6,000	6,000	6,000	6,000	72,000
Library	14,400	4,800	4,800	4,800	4,800	33,600
Consumables	24,000	10,800	10,800	10,800	10,800	67,200
Service and maintenance	6,000	6,000	6,000	6,000	6,000	30,000
Staff	(366,600)	(505,800)	(505,800)	(505,800)	(505,800)	(2,389,800)
Consultants	55,200	45,000	40,000	35,000	30,000	205,200
Project personnel (full-time)	194,400 (6 months)	388,800	388,800	388,800	388,800	1,749,600
Instructors	117,000	117,000	117,000	117,000	117,000	585,000
Participants	(358,800)	(430,800)	(430,800)	(430,800)	(430,800)	(2,082,000)
Air travel	54,000	54,000	54,000	54,000	54,000	270,000
Living expenses	304,800	304,800	304,800	304,800	304,800	1,524,000
Pilot project support		72,000	72,000	72,000	72,000	288,000
Associated activities	(18,000)	(84,000)	(66,000)	(66,000)	(66,000)	(300,000)
Development of educational modules	18,000	24,000	6,000	6,000	6,000	60,000
Workshop (primary/ secondary level)		60,000	60,000	60,000	60,000	240,000
Internal activities	(36,000)	(108,000)	(36,000)	(108,000)	(36,000)	(324,000)
Evaluation Workshops		72,000		72,000		144,000
Review Board sessions	36,000	36,000	36,000	36,000	36,000	180,000
Data Management Unit		(170,000)	(120,000)	(120,000)	(120,000)	(530,000)
Equipment/Communications		100,000	50,000	50,000	50,000	250,000
Data and Operation		70,000	70,000	70,000	70,000	280,000
	1,151,400	1,401,200	1,192,200	1,264,200	1,192,200	6,351,200

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Annex VI (d)

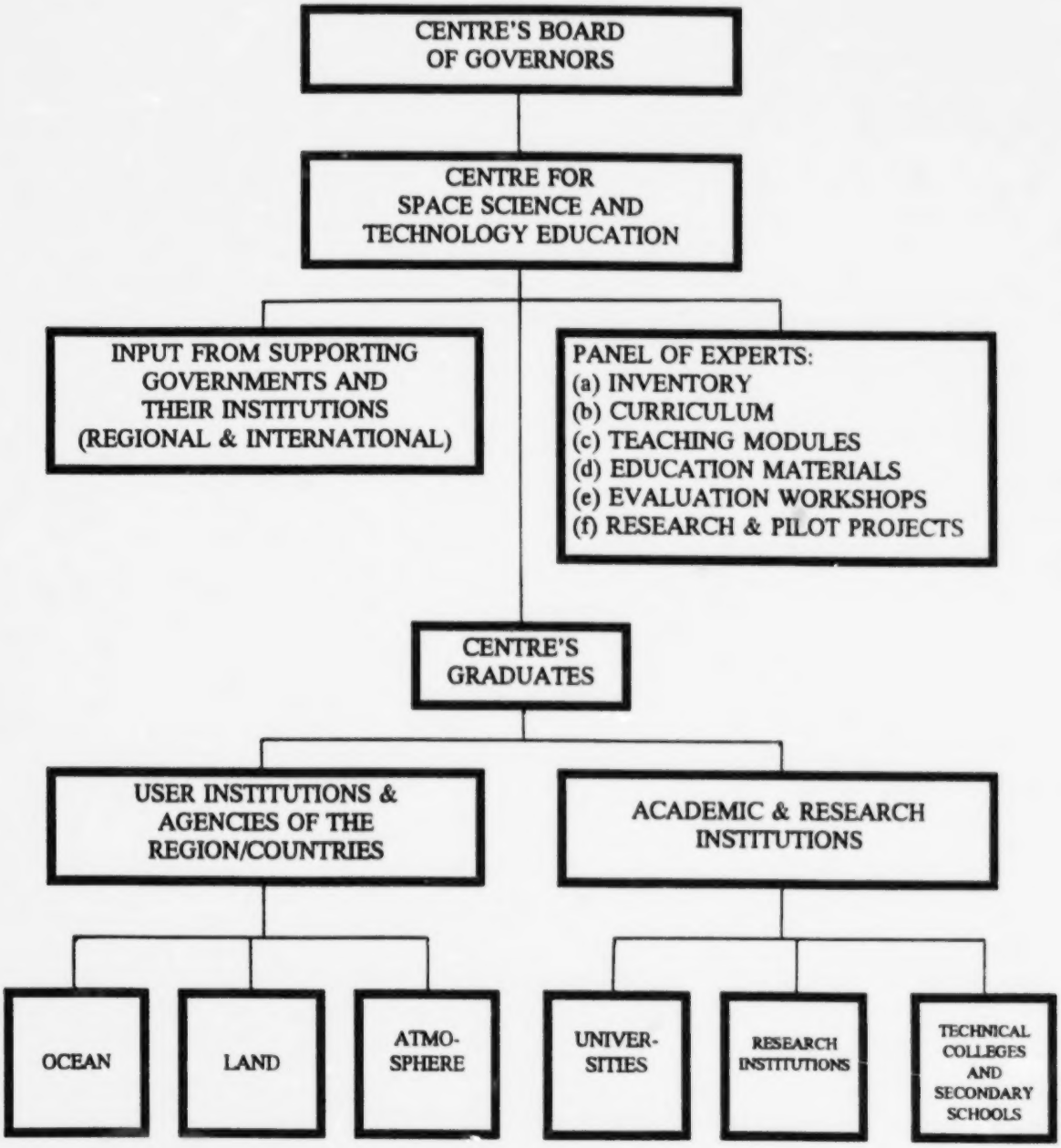
Estimated Budget

Western Asia

	Year 1	Year 2	Year 3	Year 4	Year 5	Subtotals
Preliminary Activities	(72,000)	(9,000)	(0)	(0)	(0)	(81,000)
Implement Phase I activities	60,000					60,000
Regional inventory	12,000	9,000				21,000
Infrastructure	(300,000)	(93,600)	(33,600)	(33,600)	(33,600)	(494,400)
Equipment/Laboratories	207,600	66,000	6,000	6,000	6,000	291,600
Office/Classroom furnishing	48,000	6,000	6,000	6,000	6,000	72,000
Library	14,400	4,800	4,800	4,800	4,800	33,600
Consumables	24,000	10,800	10,800	10,800	10,800	67,200
Service and maintenance	6,000	6,000	6,000	6,000	6,000	30,000
Staff	(390,600)	(574,800)	(569,800)	(564,800)	(559,800)	(2,659,800)
Consultants	55,200	45,000	40,000	35,000	30,000	205,200
Project personnel (full-time)	194,400 (6 months)	388,800	388,800	388,800 -	388,800	1,749,600
Instructors	141,000	141,000	141,000	141,000	141,000	705,000
Participants	(505,000)	(577,000)	(577,000)	(577,000)	(577,000)	(2,813,000)
Air travel	30,000	30,000	30,000	30,000	30,000	150,000
Living expenses	475,000	475,000	475,000	475,000	475,000	2,375,000
Pilot project support		72,000	72,000	72,000	72,000	288,000
Associated activities	(18,000)	(84,000)	(66,000)	(66,000)	(66,000)	(300,000)
Development of educational modules	18,000	24,000	6,000	6,000	6,000	60,000
Workshop (primary/ secondary level)		60,000	60,000	60,000	60,000	140,000
Internal activities	(36,000)	(108,000)	(36,000)	(108,000)	(36,000)	(324,000)
Evaluation Workshops		72,000		72,000		144,000
Review Board sessions	36,000	36,000	36,000	36,000	36,000	180,000
Data Management Unit		(170,000)	(120,000)	(120,000)	(120,000)	(530,000)
Equipment/Communications		100,000	50,000	50,000	50,000	250,000
Data and Operation		70,000	70,000	70,000	70,000	280,000
	1,321,600	1,616,400	1,402,400	1,469,400	1,392,400	7,202,200

Annex VII

THE FUNCTIONING OF THE CENTRE



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Annex VIII

CENTRES FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION

Potential host countries/host institutions

Region	N	Country	Institution
ECA	1.	Ghana	University of Ghana
	2.	Kenya	Collaboration of 5 national institutions & RCSSMRS
	3.	Nigeria	University of Nigeria and Obafemi Awolowo University & RECTAS
	4.	Morocco	Université Mohamed V. Ecole Mohammadia d'Ingénieurs
	5.	Senegal	Le Centre de Suivi Ecologique pour la Gestion des Ressources Naturelles (CSE)
	6.	Zimbabwe	Scientific Industrial Research Development Centre and University of Zimbabwe
ECLAC	1.	Argentina	Comision Nacional de Actividades Espaciales (in collaboration with several universities)
	2.	Brazil	Instituto Nacional de Pesquisas Espaciais (in collaboration with two universities)
	3.	Chile	Universidad de Chile (in collaboration with several universities)
	4.	Mexico	Instituto Mexicano de Comunicaciones (in collaboration with three universities)
ESCAP	1.	China	Awaiting institution's nomination
	2.	India	Indian Institute of Remote Sensing
	3.	Indonesia	Bandung Institute of Technology and LAPAN
	4.	Islamic Republic of Iran	Telecommunications University of PTT
	5.	Malaysia	MACRES and University of Malaysia
	6.	Pakistan	SUPARCO
	7.	Sri Lanka	University of Moratuwa
	8.	Thailand	King Mongkut Institute of Technology Laid Krabang
ESCWA	1.	Jordan	Royal Jordanian Geographic Centre
	2.	Oman	Sultan Qaboos University
	3.	Syrian Arab Republic	General Organization of Remote Sensing
	4.	United Arab Emirates	United Arab Emirates University
EUROPE	1.	Greece	Awaiting institution's nomination

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Annex IX

OUTLINE OF PROPOSED CURRICULUM

(a) Development of analytical skills (physics, mathematics, computer science, photogrammetry and cartography)

(b) Basic radiometry

(c) Fundamentals of meteorology

(d) Physics of imaging, including the principles of data acquisition, transmission and reception

(e) Principles of photo-interpretation (analogue and digital)

(f) Skills and knowledge development in remote sensing technology, including geographical information systems (GIS)

(g) Development of skills in applying remote sensing technology and GIS to specific application projects

(h) Development of research programmes

(i) Development and design of education and demonstration materials

(j) Curriculum development

(k) Development of skills and knowledge in computer-aided education

(l) Establishment and management of information systems

(m) Execution of research and application projects

(n) Weekly seminars on special topics on space technology